

REMARKS

Claims 16-17 and 19 are pending in this application. By this Amendment, claim 18 is cancelled without prejudice or disclaimer of the subject matter recited therein. No new matter is added.

I. 35 U.S.C. §112 Rejection

The Office Action rejects claim 18 under 35 U.S.C. §112, second paragraph. By this Amendment, claim 18 is cancelled, rendering the rejection moot.

II. Overview Of Embodiments

In embodiments, the necessity for an incubation time is avoided. Thus, productivity in the manufacture of devices having the claimed metal film can be increased. In the source gas supplying step of the initial film-forming step, the gas obtained by vaporizing an organic source is adsorbed on the substrate. Then, in the excited-gas supplying step, the plasma excited gas is supplied to the substrate. Thus, the organic source adsorbed on the substrate is decomposed and reacts with the plasma excited gas, resulting in the initial metal film. Thus, the initial film-forming step uses an atomic layer deposition (ALD) method. Because the initial metal film is formed by a surface reaction with the adsorbed organic source, an incubation time can be avoided. Thus, the productivity of manufacturing devices having the metal film can be improved (see, for example, paragraph [0096] of the specification as published).

As a further benefit, the impurities in the initial metal film can be reduced. That is, in the excited-gas supplying step of the initial film-forming step, the gas supply to the substrate is excited by plasma. Thus, this gas has high reactivity, and combines with elements such as C, O, and H contained as impurities in the organic source. As a result, these elements are reduced in the organic source. As a result, a step of improving the purity of the initial metal film can be unnecessary. Thus, the productivity of manufacturing devices having the metal

film can be improved (see, for example, paragraphs [0097] and [0109] of the specification as published). Furthermore, as a further result of the improved purity levels of the initial metal film, peeling of the initial metal film at the time of annealing due to gas desorption can be prevented (see, for example, paragraph [0097] of the specification as published).

Further, in embodiments, an incubation step can be avoided not only during the formation of the initial metal film, but also during the formation of the main metal film. Thus, the productivity of manufacturing devices having the metal film can be improved. In the main film-forming step, the main metal film is the same film as the initial metal film formed as an underlying layer. An incubation time can be avoided in the main film-forming step for reasons similar to those discussed in relation to the initial film-forming step.

Further, in embodiments, the main film-forming step is performed by thermal chemical deposition (CVD), not by ALD. Thus, the deposition rate can be improved, compared to the rate when an ALD method is used. Thus, the productivity of manufacturing devices having the metal film can be improved.

Further, both the initial and main film-forming steps are performed in the same chamber and at the same temperature. Thus, the initial and main film-forming steps can be performed in a continuous manner. As a result, a temperature fall and rise operation between the steps can be avoided. Thus, the productivity of manufacturing devices having the metal film can be improved (see, for example, paragraph [0108] of the specification as published).

III. The Claims Are Patentable Over The Applied References

The Office Action rejects claims 16-19 under 35 U.S.C. §103(a) over U.S. Patent Publication No. 2002/0197856 to Matsue et al. (Matsue) in view of U.S. Patent Publication No. 2002/0197856 to Lu et al. (Lu). The rejection of cancelled claim 18 is moot. Applicants respectfully traverse the rejection.

Regarding independent claim 16, the applied references fail to disclose or render obvious (1) "a main film-forming step of forming a main metal film being the same film as the initial metal film on the initial metal film"; and (2) "the initial film-forming step and the main film-forming step being performed in the same processing chamber and performed at the same processing temperature" (emphasis added).

Matsue discloses formation of a WN_x film (barrier film 14) at a temperature of 300-450 degrees C by an atomic level deposition (ALD) method (paragraphs [0059]-[0060] and [0072]), and formation of a W layer on the WN_x film in a same processing chamber by a thermal chemical vapor deposition (CVD) method, as acknowledged by the Office Action. However, WN_x is not the same as W and Matsue fails to disclose that the ALD method used to deposit the WN_x film and the CVD method used to deposit the W film are operated at a same temperature. Thus, Matsue fails to disclose an initial and a main metal film that are the same film, and that are both formed in the same chamber at the same temperature, as claimed. Thus, Matsue fails to disclose features (1)-(2) quoted above.

Lu discloses formation of a bulk thermal CVD layer of W at a temperature of 400-500 degrees C by a thermal CVD method. Thus, Lu fails to cure the deficiencies of Matsue.

The Office Action cites to Lu and alleges that Matsue modified by Lu would result in the ALD method used to deposit WN_x and the CVD method used to deposit W at the same temperature. First, under the proposed modification, as discussed above, the two metal films would be WN_x and W, which are not the same; thus, the proposed combination fails to result in feature (1) above. Second, as best understood from the Office Action, the Office Action appears to acknowledge that Matsue discloses a temperature range of 300-450 degrees C for the ALD method, and the Office Action acknowledges that Lu discloses a temperature range of 400-500 degrees C. Thus, under the Office Action's own interpretation, the references fail to disclose that the ALD method and CVD method would have been performed at the same

temperature. Nothing in Matsue and Lu, taken as a whole, suggest using the same temperature for Matsue's ALD method and Lu's CVD method. Thus, even if the applied references are combined as proposed, features (1)-(2) do not result.

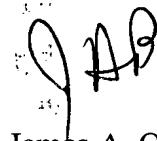
For the foregoing reasons, Applicants request withdrawal of the rejection.

IV. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



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JAO:JHB

Attachment:

Petition for Extension of Time

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